(3) *Practical Experiments in Light.* Pp. viii + 112. By W. St. B. Griffith and P. T. Petrie. (London: Rivingtons, 1916.) Price 3*s.* 6*d.* net.

(1) THE fourth edition of the "Text-book of Physics" edited by Prof. A. Wilmer Duff shows numerous changes, especially in the paragraphs dealing with the dynamics of rotation. A new part on sound has been prepared, in which recent important work is described, including the researches of Prof. Miller by means of his "phonodeik" and the experiments of Prof. Sabine on architectural acoustics. A careful study of the results obtained by the latter investigator has shown that attempts to reduce reverberation by stretching fine wires across a hall or by similar devices are entirely useless. Other sections of this excellent treatise have also been brought up to date; we notice an interesting account of Dr. Langmuir's mercury-vapour pump, which is given high praise: "Because of its remarkable simplicity and rapidity of action, it marks a great advance in methods of obtaining high vacua." The only criticism of the volume we have to make is that some of the illustrations (*e.g.* the tangent galvanometer, p. 384) are scarcely worthy of the text.

(2) and (3) The authors of these text-books on practical physics are masters at Uppingham School, and they have found, as have other teachers, that a laboratory guide, either written or printed, is requisite for the efficient teaching of large classes. There are drawbacks to every method of instruction; some students are met with who, from mental inertia or defective elementary education, seem incapable of following the description of an experiment given in print, whilst they can understand an oral account. Others, again, slavishly follow the printed page, and will even copy the diagram in their text-book instead of sketching the actual apparatus used. In such cases it is, perhaps, unfortunate that all the quantitative experiments should be illustrated by worked-out numerical examples. The books under discussion are intended "for the use of boys between the ages of thirteen and twenty." Their chief recommendation is the large number of simple experiments which can be carried out without the use of elaborate apparatus. Graphical methods are rightly emphasised, and a word of praise must be given to the clearly drawn graphs reproduced in the text. Some of the other diagrams in "Heat" are not quite so satisfactory.

The directions given are, as a rule, lucid and exact, but occasionally we find a misleading or careless sentence—*e.g.* "Do not touch the calorimeter and use the thermometer as a stirrer" (p. 50); "The temperature of different Bunsen flames vary considerably" (p. 71). The authors do not appear to realise that convection plays a more important part than radiation in the cooling of a hot body. In the chapter on calorimetry (one of the best in "Heat") the calorimeter, "bright on the outside," should not be exposed on the bench, but be supported in an outer metal vessel or be wrapped with cotton-wool and put in a beaker. The account of Newton's law of cooling is defective for the same reason. It is to be regretted that in the experiment on Boyle's law the results are tabulated with six significant figures, though the observations contain only three figures. The authors have not even the excuse of Biot, who, when his attention was drawn to a similar case, replied sarcastically that if the first figures were wrong, perhaps the last would be right. In Regnault's hygrometer the end of the boiling tube must be cut off before the metal thimble is cemented to it. There are in all fifty-nine experiments in "Heat" and sixty-eight in "Light." The experiments in "Light" are of the type now familiar, pin methods being employed frequently. In the first experiment, which purports to show that light travels in straight lines, it is necessary to prove that the hat-pin (used to test the alignment of the holes in the three cardboard screens) is straight. As an optical method is inadmissible, this might be done by fixing two of the screens, rotating the hat-pin, and noticing whether there is any lateral displacement of the third screen. The questions addressed to the student form a valuable feature in connection with the earlier part of the Light course. H. S. A.

THE TECHNOLOGY OF TYPOGRAPHICAL PRINTING SURFACES.

Typographical Printing-surfaces: the Technology and Mechanism of their Production. By L. A. Legros and J. C. Grant. Pp. xxiv + 732. (London: Longmans, Green and Co., 1916.) Price 2*l.* 2*s.* net.

THIS work is the outcome of a paper read by one of the authors before the Institution of Mechanical Engineers a few years ago: the paper created at the time some amount of interest in the printing world owing to the thoroughness with which it had been prepared. That matter has now been considerably enlarged—perhaps too much so in some instances—but we must readily admit the usefulness of the bulk of the information collected together, because of its previously being scattered abroad in many directions, and due credit must be given to the compilers for the great labour involved in bringing together so much valuable material; certainly as a work of reference on its subject the book will be found most useful.

The volume is jointly dedicated to our first authority on printing, Joseph Moxon, 1627–1700, and to the French writer, Simon Fourrier, another great authority, 1712–68, and is a stupendous work of its kind. As it professes, it covers a good deal of the ground which hitherto has been but scantily treated, so far as type-founding is concerned, in any English text-book on printing ever published. In fact, Moxon, in his "Mechanick Exercises," 1683, is the only writer

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who has attempted to deal with this subject to any extent. Naturally, at that period Moxon treated of typefounding by the hand method of casting, but in the large work now under notice the founding of even single letters is shown to be produced by many machines of various kinds. Hand-casting is rarely used nowadays, except for the occasional casting of small orders or for special purposes. Further, in adopting mechanical means many of the preliminary and finishing stages needful in the old hand method are now dispensed with.

Even as hand-press work is not to be compared with the output of the power-press, so it is with typefounding—thousands of letters are now turned out in the place of a single hundred, and the comparison is even greater when the rotary system of casting is employed.

As its title implies, the work is confined to the production of typographical surfaces of all kinds, and this covers a very wide range indeed. It includes not only hand-set types and those composed by different machines, but engraved blocks, reproductions by the stereotype and electrotype methods, process blocks, and all other surfaces in relief. The details of designing type faces—a most important matter if a good fount is desired—punch cutting, and the making of the matrices and moulds for the final stage of casting, are all admirably described, particularly so from both the draughtsman's and the engineer's point of view. Besides very full and concise descriptions of the various casting machines in use at the present time, the different systems of type-composing machines from their first conception up to recent date have several chapters devoted to long and technical descriptions.

In addition to several useful appendices, much other information of a general character is given —most interesting to those practising, or who are students of, the art of printing—which stamps the volume as a valuable work of reference.

The numerous diagrams have been very carefully drawn, and the reproductions of other illustrations are equally well rendered. These, with a number of useful tables, a technical vocabulary in three languages, and a very full index, complete a work which must create a demand for its possession.

The authors are deserving of praise for the careful labour they have bestowed on the compilation of this bulky and useful volume. It certainly must be a great revelation to non-technical readers, who can have but a faint idea of the vast amount of detail underlying the fundamental stage of preparing typographical surfaces for the printing press, the greater portion of which only developed during the closing years of the nineteenth century. It all helps to prove how necessary a scientific training is for the technical education of our future craftsmen.

The typographical production of the book itself must have been a great tax on the resources of the printers responsible, and they are to be congratulated on the result.

IS VARIATION A REALITY?

Evolution by Means of Hybridization. By J. P. Lotsy. Pp. viii + 166. (The Hague: Martinus Nijhoff, 1916.) Price 6*s.* net.

DR. LOTSY'S book is one of many signs that biologists are growing uneasy about the adequacy of evolutionary theory. By whatever doubts the doctrine of Selection was assailed, it has hitherto been common ground that in their generations the forms of life varied abundantly, and that somehow through these variations the diversity of species had come to pass. Modern genetic research has led to the paradoxical discovery that much of the best evidence of variability is capable of other interpretations. Consider the "variation" of any polymorphic moth. No one doubted that from any of the varieties any other might be bred. Now we see that was a mistake. Such variation is not promiscuous, and the varieties are really an orderly series consisting of distinct types which will breed as true as any species, and of mongrel forms which can throw certain fixed types, and those only. The Mendelian conception of the homozygote has raised a new problem. The question arises: Can the offspring of homozygotes vary? Dr. Lotsy is sure they cannot. New forms can only come by crossing. That is the thesis of this book. "*Crossing, therefore, is the cause of the origin of new types; heredity perpetuates them; selection is the cause,* not of their origin, as was formerly supposed, *but of their extinction.*"

This is a bold pronouncement, and it contains much of truth. We think not merely of the many species suspected of hybrid origin, but comprehensively of the innumerable species, now perfectly distinct, which can quite reasonably be thought of as segregates derived from some cross ages ago. Few also now believe that the domesticated forms comprising many breeds really had single origins. Apart from difficulties introduced by exact genetic knowledge, modern writers have felt driven to suggest "polyphyletic" origins for pigeons, fowls, dogs, cereals, the common fruits, etc. Almost whenever the history of a modern breed is known it can be traced to a cross. Dr. Lotsy took over a wonderful F_2 from a cross in Antirrhinum made by Prof. Baur, and, as he rightly says, it contained many types capable of perpetuation as incontrovertible species. Most geneticists have seen such series and been tempted to similar conjectures. But Dr. Lotsy is for taking still wider flights. Geology shows, he says, that new classes appear suddenly with many highly differentiated forms—the Cycads, for instance, of Mesozoic times. May not they be the direct consequence of some cross? Perhaps; but whence came the original diversity? Why were there distinct forms ready to be crossed? We find no answer to that fundamental question. In the view of the present writer, too, the doctrine of invariability of the homozygote cannot be maintained. Variability is rarer than we supposed, but it is a genuine phenomenon witnessed in unimpeachable examples.

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